THE ROLE OF LINE OF CREDIT IN MUTUAL FUNDS LIQUIDITY: DETERMINANTS AND IMPLICATIONS

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ABSTRACT

Liquidity is an increasingly significant issue that fund managers pay vigorous attention to. While the pervious literature focuses on the mutual fund liquidity management and various other liquidity tools, the determinants and implications of credit lines are not well understood. This study examines the effects of monitoring mechanism, sales restrictions of funds and the financial crisis on funds' participation in the line of credits. Our results also show that credit lines have significant impact on funds' cash holdings and therefore is a good substitution of line funds' cash holdings. We also examine the flow-performance sensitivity of funds after using credit lines. The credit lines would reduce the capital flow in the next period but not weaken the flow-performance sensitivity.

BIOGRAPHICAL SKETCH

Jingyi An was born in Taiyuan, the capital city of Shanxi province. Before coming to Cornell, she completed her double degrees in the University of International Relations and Peking University, studying English language and literature as well as economics.

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CHAPTER 1

INTRODUCTION

Liquidity is an increasingly significant issue that funds managers pay vigorous attention to. First, funds claim they are more liquid than their underlying assets and make the so-called liquidity transformation - liquid claims backed by illiquid assets - happen (Chernenko and Sunderam, 2016). As a result, the promise of liquidity helps funds attract investors. Second, illiquid funds are more likely to face with the run-like behaviors of investors and therefore causes financial instability problems - this is true for both illiquid equity funds (Chen, Goldstein, and Jiang, 2010) and illiquid corporate bond funds (Goldstein, Jiang, and Ng, 2017). Moreover, mutual funds provide more liquidity to those investors who redeem their capital first, which motivate investors withdraw their investments in the early stage to gain the "first-move advantage". This phenomenon is especially common when the funds perform badly, i.e. when the return is negative. Third, holding liquidity enables managers to make quick decisions when encountering new investment opportunities in high quality underlying assets. Funds that hold high abnormal cash outperform their low-cash-holding counterparts by over 2% a year (Simutin, 2013).

However, holding liquidity can cause several problems. One of the concerns is sometimes holding cash means the capital is not fully invested in the most efficient area (Liu and Mello, 2011). So, fund managers usually explore alternative liquidity tools, such as interfund lending (Agarwal Zhao, 2018), asset-backed commercial paper

money market mutual fund liquidity facility (Duygan-Bump et al, 2013). Previous literature focuses on the usage and implications of various liquidity tools. However, the research on line of credit is very few. In this paper, we extend the study to line of credit, which is a short-term cash loan provided to funds that can be easily withdraw when needed. If funds participate in the line of credit, it might need to pay a committee fee to the financial institution, unless the fund meets certain qualification for a waiver. The interests of credit lines are only paid after the actual withdrawal happened.

In a similar vein with the mechanism of cash holdings, using line of credit could bring about a lot of advantages. As a source of short-term loan, credit lines could guarantee outflows of various purpose. Having the assurance provided by credit lines, fund managers do not have to worry about the potential cost of sale fire. Moreover, compared with cash holdings, using line of credit additionally improves the efficiency of capital allocation as it does not occupy the capital that could have allocated to more profitable targets. As a result, it mitigates the hard balance between liquidity needs and profitable purpose of funds.

We addressed the following questions in our study: 1) What are the motivations of participating in the line of credit? 2) What fund characteristics are important to determine the participation of line of credit? 3) Could credit line be a good substitution of cash holdings? 4) To what extend that credit line affect funds'

cash holding? 5) How would it affect the relationship between fund capital flow and fund performance?

First, we examine the determinants of funds' decision on participation in line of credits. We consider funds with good monitoring mechanism and strict sales restrictions more likely to be financially stable. Therefore, those funds would face less run-like behavior and therefore use credit lines less. Also, we find that funds are more likely to use line of credit during the financial crisis in 2007-2009.

Then we focus on the implications of line of credits. One of the things we start with is the relationship between funds' cash holding and line of credit. We think the line of credit could relieve the pressure of potential investors' redemption and therefore reduce the need for funds to hold too much cash in their accounts. The results suggest that line of credit contributes to reducing the liquidity burden of funds. The other thing we pay attention to is the change happened to flow-performance sensitivity after using line of credits. We find that the impacts of performance on fund capital flows are stronger for negative-return funds than that of positive-return funds. However, for both good and bad-performed fund, the increase of return would increase the investment for the funds. And it is also true for both institutional funds and retail funds.

Our paper contributes to the literature in several aspect. First, the data we use is hand-collected from the filings of U.S. Securities and Exchange Commissions. We

are the first to use the exact amount of credit lines rather than the action itself. This provide our readers a new aspect to consider the liquidity tools. Second, while there are literature focuses on other liquidity tools of funds, we extend the analysis to line of credit.

1.1 Literature Review and Development of Hypotheses

Two things are profoundly significant regarding to the research on line of credit. The first one is the specific characteristics that would determine the funds' decision on participation in and usage of line of credit. The other one is the implications on fund after using the line of credit. In order to solve the problems, we derive the following hypotheses.

Hypothesis 1: a) Funds with better monitoring mechanisms, stricter sales restrictions are less likely to participate in the credit lines than their peers. b) During the time of financial crisis, funds are more likely to use credit lines than other periods.

Our first hypothesis is regarding to the determinants of line of credits. In our definition, the monitoring mechanism mainly contains two elements. The first is the rear load fee that funds charge to their investors. The back-end load is a fee that investors need to pay when redeeming their mutual fund shares. It is a percentage of the share that being sold related to fund policies. However, there are also some actively managed so-called "no load" funds that charge zero sales cost on their investors. And Malkiel (2013) suggests that the fee is a positive sign that the funds

have good management and performance. In another words, back-end load fee makes it harder for investors to redeem their investment and therefore make them to provide better monitoring over the funds.

Then we consider institutional funds to be more likely to have better monitoring mechanism compared with their retail peers. Institutional investors can be more sensitive to high fees and bad risk-adjusted performance. On average, an institutional fund outperformed its retail peers – with the same manager and similar strategy – by 1.5% (Evans and Fahlenbrach, 2012). Therefore, we think institutional funds are less likely to need to use the line of credit.

In the non-crisis period, holding illiquid assets could bring about a so-called illiquidity premium to funds, while in the crisis period the premium would turn to be discount (Schaub and Schmid, 2012). During the crisis time, fund with low liquidity would have low returns. In order to increase the liquidity during crisis time, funds are more likely to need the line of credits.

Hypothesis 2: Funds would hold less cash after participating in line of credit.

Funds with liquidity can react quickly to new investment chance and investors' redemption and therefore avoid the cost of sale fire. However, some researchers concern that the holding cash would cause financial instability problem and reduce the efficiency of investment capital. Using line of credit is a good way to solve the

disadvantages of holding cash because it does not squeeze the capital budget for other investment opportunities.

Hypothesis 3: a) Funds' performance and application of line of credit would affect the funds capital flow. b) Capital flow is more sensitive to performance for funds with negative returns, compared to that of its positive-return counterparts. c) Using credit lines would weaken the flow-performance relation of funds.

For both corporate bond funds and equity funds, the impact of good and bad performance on capital flow is asymmetry (Chen, Goldstein, and Jiang, 2010; Goldstein, Jiang, and Ng, 2017). The investors are more sensitive when the funds perform badly because they are eager to redeem their money from the fund once the performance worsens. Therefore, a decrease in return for bad funds are more likely to lead to a strong capital outflow. Also, we think using line of credit would mitigate the run-like behavior and thus weaken the investors' sensitivity to the funds' performance.

While the line of credit provides funds with liquidity, investors can withdraw their capital readily when the funds have access to credit lines. Since the actively-managed institutional investors have better monitoring mechanism, it is more convenient for them to react according to funds' performance.

CHAPTER 2

DATA

We gathered two datasets on mutual funds from 1995 to 2016. The first one from SEC filings shows how funds participate in line of credits. The second dataset is collected from Center for Research in Security Prices (CRSP), covering comprehensive information on mutual funds. This enables us to analyze the determinants and implication of funds' borrowing behavior. Details on the datasets are provided below.

2.1 Line of Credits Data

Funds' participation in the line of credits are for short-term liquidity purposes, such as shareholder redemptions. For funds that has applied for the line of credits, there are mainly two cases in its utilization. First, some funds would not make any borrowing during the reporting period because there is no such need. For instance, Dreyfus Institutional U.S. Treasury Money Market Fund participated in a $100 million unsecured line of credit but did not used it during the first half of 2003. Second, they may participate in the redemption credit facility and pay the interest based on prevailing market rates. For example, Dreyfus Disciplined Stock Fund, a separate diversified series of the Dreyfus Funds, participates with other Dreyfus-managed funds in a $500 million redemption credit facility. In the contract, the fund decided to pay the commitment fees on its portion of facility. During the period, the fund used

daily amount of borrowing of first half of 2003 was about $205,500, and the weighted average annualized interest rate is 1.68%.

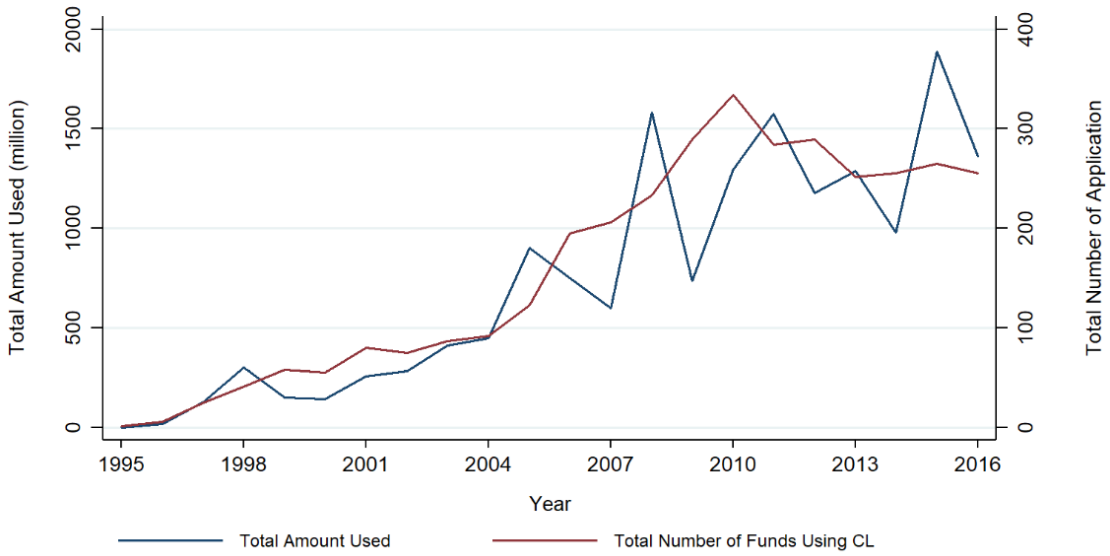
We manually collected data on funds' line of credits from SEC company filings (Forms N-30D, N-CSRS and N-CSR, specifically). Using "line of credit", "line of credits" and "credit lines" as key words, we searched all the fund filings between 1995 and 2016 and manually recorded the amount they borrowed, the interest rate quoted, the interests they paid and the day outstanding. We also recorded the summary information of the filing, such as trust names, fund names, file dates and report dates. We later used them as keys to merge with mutual fund data from CRSP. Since the financial filings are reported half-yearly, this is also the time interval for the dataset. We have 21,563 observations in the dataset, covering the filings of 5371 funds[1]. During the recorded period, there are 5,157 borrowing behaviors in total, with an average loan balance of $8.7m. The weighted average interest rate is 2.64%, and the average interest amount is $27,287.

Figure 1 shows all funds' total number of applications for line of credits and the total amount of credit lines used from 1995 to 2016. We find that both numbers increase significantly overtime. Since the first applications in mid 1990s, the number of applications increased steadily to its peak at 330 in 2010, and then drop to around 250 in later years. The total amount of credits used increased from below $300m in the late 1990s to $1.5b in 2016, with large fluctuations over the years. The average amount of one borrowing behavior for each year fluctuates between $2.5m to $7.33m

[1] If a fund borrows through line of credit in a given time period, all its peer funds in the same family will appear in our dataset.

without a clear pattern over time. Our data suggests that it has become increasingly popular among funds to participate in line of credit in the past two decades.

Figure 1 Total Number of Applications and Total Amount Used (1995-2016)



2.2 Mutual Fund Data

We downloaded 4 datasets from Center for Research in Security Prices (CRSP) and incorporated them using time and CRSP fund number2 as keys. We collected monthly data on fund summary, return and dividend, covering the same period as SEC filings from 1995 to 2016. Fund summary includes fundamental information such as net asset value, maturities, amount of fund invested in different categories (stocks, bonds, other securities and cash), as well as fund characteristics (whether the fund is

[2] CRSP Fund Number is a specific identifier CRSP database gives to every fund.

money market fund, ETF or ETN, dead or not). The dataset also includes control variables such as funds' expense ratio, size and cash holdings. Additionally, we collected funds' rear-load strategy with their beginning and end dates.

To prepare for the merging with SEC filings, we reconstructed all CRSP datasets into half-yearly: for monthly datasets, we keep data from the last available month in each half year; for the rear-load dataset, we expand the observations to half-yearly and create a dummy variable, assigning value 1 if a fund used any rear-load strategy for at least one month in a given half year.

2.3 Data Construction

In order to merge datasets from two sources, we match each line-of-credit application in the SEC filings to CRSP by their trust and fund name. To do this, in both datasets, we created unique lists of trust-fund name by concatenating the trust name and the fund name - there are 5,371 unique trust-fund names in the SEC dataset and 48,347 in CRSP. Unfortunately, there are only 1,928 funds that has identical trust and fund names in both datasets. For funds without an exact match, we use Levenshtein distance as a string metric to find the closest match in CRSP. Trust-fund names in the SEC dataset are matched with their counterparts in CRSP with minimal distance, and the match is manually selected in case there is a tie. Additionally, we inspect matches that has a minimal distance of 10 or greater or if only less than 80% of

the length is matched. As a result, we can match an additional 2,163 trust-fund names, with 4,091 out of 5,371 names matched in total.

Then, we used this map to merge with both Edgar data and CRSP data respectively to get our final data sample. When merging with SEC data using map, we matched 17,234 observations and lost 3,965 of them. In another word, for these 3,965 observations in Edgar dataset, we could not find the exact match in CRSP dataset. Then we analyzed the two samples, the matched sample and the unmatched sample, to make sure there is no significant difference in the characteristic of the two sample so that there is no bias created by dropping the 3,965 observations.

Figure 2 Percentage of Borrowing Case for Both Samples (1995-2016)

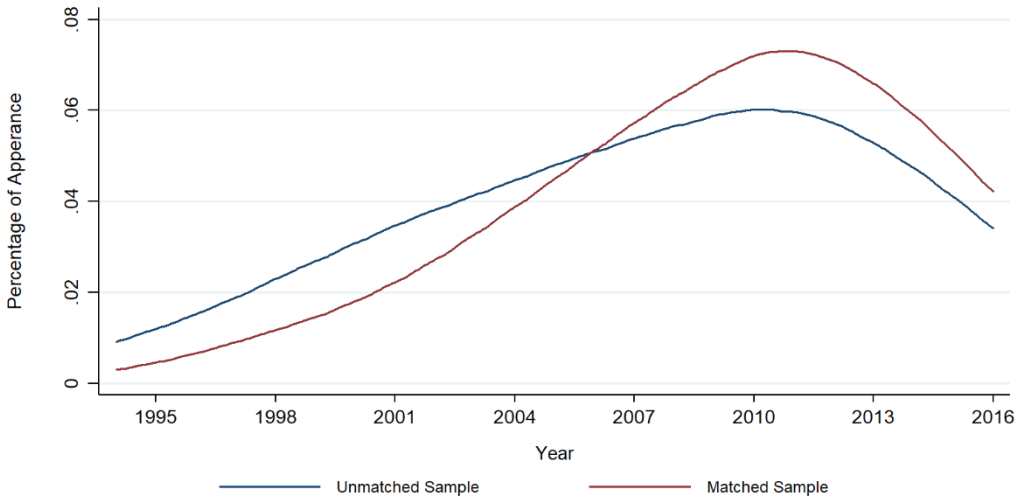
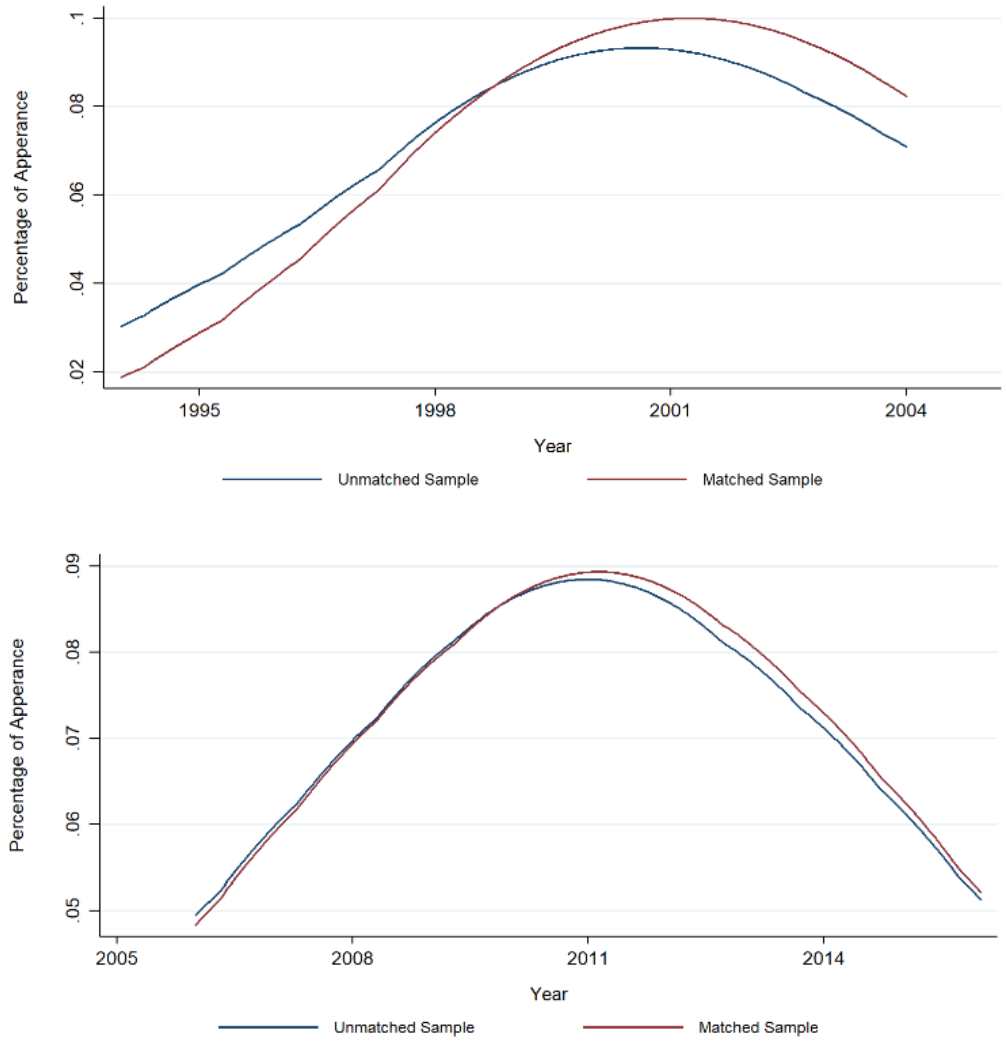


Figure 3 Percentage of Borrowing Case for Both Samples (Two Time Periods)



From Figures 2 and 3, we observed that both matched and unmatched sample shows similar trend in density. The number of lines of credit used increased first between 1995 and 2011 and then slightly dropped after 2011. If we use the year of 2005 as a cutting point and smoothed the line by 3-year period, it is easy to find that

the trends of both samples are very similar. From this perspective, we think the matched sample we used is unbiased. However, we will consider the observations before 2005 and after 2005 as different subsamples and conduct separate analysis for both subsamples. The resulting dataset contains 1,013,909 half-yearly fund observations.

2.4 Variables Construction

2.4.1 Measures of fund flows

We use the percentage of change in Total Net Asset in the given half year as the measure of funds' flow in that period:

$$\text{Flow}_{t,n} = \frac{TNA_{t,n} - TNA_{t-1,n}(1 + ret_{t-1,n})}{TNA_{t-1,n}}$$

where *n* denotes the fund and *t* denotes the half year. We winsorized top and bottom 5%.

2.4.2 Measures of line of credit

We use two ways to measure funds' application and participation of line of credit. The first measure is a dummy variable *cl*, with 1 denoting that the funds have used the line of credits in a given half year and 0 otherwise. Specifically, we deem that a fund had used the line of credits during the reporting period if we find at least one of the following information in the SEC records: loan balance, interest amount, interest rate and day outstanding.

Moreover, our study also focused on the amount of the line of credits that funds used – this is defined as *cl_amount*, denoting the loan balance of line of credits. We winsorized top and bottom 5% of *cl_amount* to rid the variable of extreme values.

2.4.3 Measure of monitoring mechanisms

We used two ways to estimate whether the funds have efficient monitoring mechanisms, *inst* and *load_dum*. The first variable took value 1 if it is an institutional fund and 0 otherwise (which means it is a retail fund). We consider the institutional funds have better monitoring mechanisms due to their better management, more strict rules, and more independent boards.

The second measure *load_dum* took value 1 if the funds charged rear load fee to their investors and 0 if not. If the funds charge the back-end fee to their investors, then it cost more for investors to redeem their shares. Consequently, they will look closely at the funds to make sure it is in good condition. Therefore, we regard back-end fee as an indicator for external monitoring.

2.4.4 Variable for the financial crisis

At the time of financial crisis, the funds are more likely to need liquidities to deal with investors' redemption. We generated a variable *timing* that equals 1 if the reporting period is in the financial crisis and 0 otherwise. We set the financial crisis period from first half of 2008 to second half of 2009.

2.4.5 Measure of sales restrictions

If the funds have sales restrictions, it might be more stables on the demand of redemption. We generated a variable called *sales*, which equals 1 if the fund is affinity or employee-only fund and 0 otherwise.

2.4.6 Control variables

Besides *flow*, we defined three more control variables, *expr*, *turnr*, and *size*, each denoting the expense ratio, the turnover ratio and the logarithm value of total net assets in the latest reporting period.

The summary statistics for all the variables we discussed above are presented in table 1.

Table 1: Summary Statistics

Variable	N	Mean	Std. Dev.	Min	Max
Line of Credit					
cl	542,834	0.006	0.077872	0	1
cl_amount	3,312	2,993,403	19,400,000	0	454,000,000
Liquidity					
cash	483,319	3.252	4.767	-1.15	18.4
Characteristic of Funds					
inst	537,382	0.375	0.484	0	1
load_dum	542,834	0.132	0.338	0	1
sales	542,834	0.003	0.056	0	1
timing	542,834	0.190	0.392	0	1
Control					
expr	455,327	0.013	0.006	0.002	0.024
turnr	450,208	0.747	0.632	0.07	2.45
size	530,717	3.166	2.744	-4.60	12.32
flow	485,856	0.107	0.357	-0.36	1.172

The average loan amount of credit lines is 2,993,403 with a maximum of 454,000,000. The cash that funds hold averaged at $3.25m and peaked at $18.4m. And if the funds have very short-term borrowings, the number dropped to negative with a minimum of -$1.15m. The average value for expense ratio, turnover ratio, size and flow of the funds are 1.31%, 74.80%, $3.16M and 10.76% respectively.

CHAPTER 3

EMPIRICAL ANALYSIS

3.1 Determinants of participation in line of credit

We first identified the determinants of line of credit. We used the *cl* variable as dependent variable and funds' characteristics as independent variables. The impacts on the possibility of using line of credit is estimated as follows.

$$\mathrm{CL}_{t,n} = \alpha\, Monitoring_{t,n} + \beta\, Restrictions_{t,n} + \gamma\, Timing_{t,n} + \delta X_{t,n} + \varepsilon_{t.n}$$

Where t denotes the time, n denotes the fund and X denotes the controls. Monitoring represents the monitoring mechanism, restrictions refer to sales restrictions and X contains four controls variables, namely expense ratio, turnover ratio, capital flow and size. In all the regressions, we included *inst*, *load_dum*, *sales* as independent variables. In regression (1) and (3), we also used the dummy variable of *timing.* Because the sample time period of (1) and (3) includes 2008-2009, we didn't use half-year time fixed effects to control for the impact of unobservable changes happened in different years.

Table 2 reports the estimated results of the equation above. The result (1) suggest that the possibility of using line of credits is negatively related to the monitoring mechanism and sales restrictions. Besides, during financial crisis period, funds are more likely to use line of credit. The parameter shows that if the funds are institutional, the possibility of using line of credit would decrease by 0.49 percent. The impact is significantly negative. If a fund is an institutional fund, it might be more stable in capital so that it does not need to use the line of credit. For the rear load fee,

it would reduce the possibility of credit lines by 0.20 percent. It is because if funds charge rear load fees to their investor, it would be harder for the investors to withdraw their money. So, the funds don't need to ask for much credit lines from the bank. At a similar vein, the rule of sales restriction would decrease the possibility by 0.95 percent. If the funds have sales restrictions, it would enjoy higher level of capital stability and therefore the funds don't require much liquidity. Because the effect of financial crisis is insignificant, looking into the coefficient is meaningless. However, the sign is positive as we expected.

In result (2) we report the estimation after adding time fixed effect to the full sample. We observe that the institutional feature would have a stronger influence on funds' usage of credit lines. And the effect of rear load and sales restrictions decreased by 0.0009 percent and 0.0072 percent. The funds' characteristics still have similar impact on the dependent variables. Because we added the time fixed effect in the analysis, we excluded the timing variable out from the original equation (1). And the same things happened for (5) and (6).

In order to do the robustness check, we decided to construct two subsamples, one contains observations before 2005 and the other after 2005. The result (3) and (4) are using the subsample after 2005 and (5) and (6) used the one before 2005. And we added time fixed effect to (4) and (6). We observed that for the subsample before 2005, institutional feature has stronger effects, but load fee and sales restrictions have a weaker impact on the dependent variable, compared with the subsample after 2005.

As for the result for those controls we used, it turned out to have significant effects on the dependent variable as we expected before. An increase in expense ratio and capital flows and a decrease in turnover ratio and capital size would all decrease the possibility of line of credit. When the expense ratio increases 100%, the possibility of line of credit would decrease by 23.5 percent. If the capital flow increased 100%, the possibility of line of credit would decrease by 0.28 percent. Besides, the coefficient for turnover ratio and size are 0.0012 and 0.0011 respectively, meaning an 100% increase in expense ratio and $1M in capital size would increase the possibility by 0.12 and 0.11 percent.

Table 2 Determinants of Line of Credits

Dependent Variable: *cl* (=1 if the fund used line of credit)

	Predicted Sign	(1) 1995-2016	(2) 1995-2016	(3) 2005-2016	(4) 2005-2016	(5) 1995-2005	(6) 1995-2005
Characteristics of funds							
inst	+/-	-0.00488***	-0.00504***	-0.00553***	-0.00549***	-0.00241***	-0.00252***
		(0.000284)	(0.000285)	(0.000318)	(0.000319)	(0.000543)	(0.000543)
load_dum	-	-0.00205***	-0.00194***	-0.00196***	-0.00193***	-0.00203***	-0.00210***
		(0.000347)	(0.000348)	(0.000407)	(0.000408)	(0.000524)	(0.000524)
sales	-	-0.00951***	-0.00879***	-0.0117***	-0.0115***	-0.00430	-0.00421
		(0.00196)	(0.00196)	(0.00251)	(0.00251)	(0.00238)	(0.00238)
timing	+	0.000583		-0.000195			
		(0.000300)		(0.000321)			
Controls							
expr	-	-0.235***	-0.202***	-0.241***	-0.236***	-0.0589	-0.0620
		(0.0254)	(0.0257)	(0.0290)	(0.0292)	(0.0459)	(0.0459)
turnr	+	0.00116***	0.00137***	0.00153***	0.00153***	0.000743*	0.000829**
		(0.000196)	(0.000197)	(0.000231)	(0.000231)	(0.000304)	(0.000305)
size	+	0.00109***	0.00114***	0.00125***	0.00127***	0.000396***	0.000396***
		(0.0000475)	(0.0000479)	(0.0000533)	(0.0000536)	(0.0000912)	(0.0000914)
flow	-	-0.00278***	-0.00279***	-0.00306***	-0.00319***	-0.00156**	-0.00166**
		(0.000338)	(0.000352)	(0.000390)	(0.000406)	(0.000557)	(0.000576)
cons		0.00679***	0.00620***	0.00710***	0.00693***	0.00364***	0.00366***
		(0.000489)	(0.000491)	(0.000546)	(0.000547)	(0.000965)	(0.000965)
df_m		8	7	8	7	7	7
Time FE		No	Yes	No	Yes	No	Yes
N		422556	422556	351683	351683	89993	89993

Then we used the *cl_amount* variable as dependent variable and funds' characteristics as independent variables, estimating independent variables' impact on the loan balance amount of line of credit. As a result, the full sample we used are observations with loan balance in our dataset. Because there are only very few funds used both line of credit and sales restrictions, we excluded this dependent variable from the equation. We used the formula as following:

$$\text{CL\_Amount}_{t,n} = \alpha\, Monitoring_{t,n} + \beta\, Restrictions_{t,n} + \gamma\, Timing_{t,n} + \delta X_{t,n} + \varepsilon_{t.n}$$

Where t denotes the time and n denotes the fund. Because there are very few observations before 2005 (the sample size is just about 200 observations), we only analyzed the full sample and subsample after 2005. These regressions show similar results of these variables with the last regressions. Result (1) suggests that institutional feature and load fee are negatively related to the loan balance and the timing's effect is positive. If funds are institutional funds, their loan balance would decrease by $336K. If the funds charge back-end fee to their investors, the loan balance would decrease by $4M. During the time of financial crisis, funds increase their loan balance by $297K compared with other years. However, the effect of institutional feature and timing is not significant on 95% level.

In result (2), we added the fixed effect of time and therefore exclude timing variable from the equation. We noticed that the institutional feature would have a weaker influence and load fee would have a slightly stronger effect compared with result (1), which are $283K and $4.2M, respectively.

In equation (3) and (4), we used the subsample after 2005. They do show a stronger effect of institutional features and load fee. But the impact of institutional feature and timing is still insignificant.

Table 3 Determinants of Loan Balance Amount

Dependent Variable: *cl_amount* (amount of loan balance)

	Predicted Sign	(1) 1995-2016	(2) 1995-2016	(3) 2005-2016	(4) 2005-2016
Characteristics of Funds					
inst	+/-	-336443.9	-283033.4	-495248.3	-454975
		-1163005.2	-1195513.1	-1260243.9	-1293792.8
load_dum	-	-4027838.7**	-4184663.7**	-4734275.4**	-4872401.8**
		-1528922.2	-1541556.9	-1702007	-1711437.2
timing	+	297132.8		198507.8	
		-1118500.8		-1188631.5	
Controls					
expr	-	397775993.1***	428483161.2***	481540832.7***	506353735.6***
		-109006422.5	-111432626.5	-122289676.5	-123935276.5
turnr	+	-2162565.1**	-2234547.7**	-2327638.2**	-2462354.6**
		-756243.8	-770136.8	-845452.1	-853844.7
size	+	1227129.5***	1282931.7***	1399119.8***	1459108.9***
		-234721	-239634.6	-262418.7	-266912.5
flow	-	-2351566.3	-1637493.3	-2460968	-1690316.4
		-1672540.9	-1854329.4	-1894628.8	-2108834
cons		-5063923.5*	-5607083.7*	-6510481.1**	-6971334.5**
		-2265898.6	-2322852	-2514497.7	-2565566.9
df_m		7	6	7	6
Time FE		No	Yes	No	Yes
N		2469	2469	2234	2234

3.2 IMPLICATIONS

3.2.1 Liquidity

We are also interested in the implications of line of credit. First, we focus on its impacts on liquidity. We used the *cash holding* as a proxy for funds' liquidity in this analysis and then used the *cash holdings* of next year as the dependent variable of the regression. Then we used the dummy variable *cl* of current year as dependent variable and use the timing variable as controls. The equation is as follows:

$$\text{Cash}_{t+1,n} = \alpha\, CL_{t,n} + \beta\, Timing_{t,n} + \varepsilon_{t.n}$$

Where t denotes the time and n denotes the fund. Table 3 summarized the OLS regression result for the impact. (1) and (2) used the full sample, while (3), (4) used the subsample after 2005 and (5), (6) used the other subsample. We also added time fixed effect to (2), (4), (6). All the results show that line of credit have a significant negative effect on liquidity represented by cash holdings. (1) suggests that the usage of line of credit would decrease the $0.523M for the full sample. Compared to the full sample, (3) finds a slightly weaker impact of $0.495M after 2005 and (5) gives a stronger effect of $0.944M before 2005. All the result after adding the fixed effect shows a slightly weaker effect than that of not doing so. When funds have line of credit, they would expect less liquidity in the future year because they don't need to prepare much for investor redemption. As a result, they would hold significantly less cash in their account.

During the year of financial crisis, funds still need to hold more cash in their hand. For the full sample, during the crisis funds hold $0.1M more than the normal time. For the subsample after 2005, the number would be $0.16M.

Table 4 Implications on Liquidity of Line of Credits

Dependent Variable: Cash holdings

	Predicted Sign	(1) 1995-2016	(2) 1995-2016	(3) 2005-2016	(4) 2005-2016	(5) 1995-2005	(6) 1995-2005
cl	-	-0.523***	-0.481***	-0.495***	-0.476***	-0.944***	-0.883**
		(0.0863)	(0.0860)	(0.0891)	(0.0889)	(0.286)	(0.285)
Controls							
timing	+	0.103***		0.160***			
		(0.0170)		(0.0173)			
cons		3.198***	3.220***	3.141***	3.179***	3.498***	3.498***
		(0.00792)	(0.00699)	(0.00850)	(0.00740)	(0.0174)	(0.0174)
df_m		2	1	2	1	1	1
Time FE		No	Yes	No	Yes	No	Yes
N		456961	456961	413881	413881	62896	62896

3.2.2 Flow-performance Relationship

Then we began to analyze the impacts of credit lines on flow-performance relationship. We used flow of next period as dependent variables. Because we believe the funds with good and bad performance will have different relationship with its performance, we generated two new variables, *perfpos* and *perfneg*, to indicate the funds' return of last month with positive return and negative return, respectively. The equation we used is as follows:

$$\text{Flow}_{t+1,n} = \alpha\, perfpos_{t,n} + \beta\, perfneg_{t,n} + \gamma\, cl_{t,n} + \omega_t + \varepsilon_{t.n}$$

where t denotes the time and n denotes the fund. Besides, X is the control variables, including cash holding (representing the liquidity level) and ω is the half-yearly fixed effects. Table 5 reports the results of regressions in the question above. (1) used the full sample of 1995-2016. We observed that one percent increase in funds' positive performance will increase the funds' flow by 0.585 percent. Also, one percent increase in funds' negative performance will increase the funds' flow by 0.715 percent. This shows that while the performance of funds improves, it will be more attractive to investors and therefore induce inflows. Moreover, the effects of good and bad funds' performance are asymmetric as the results showed. This is economically meaningful, with the similar vein of Chen, Goldstein, and Jiang (2010). The effect of bad performance is stronger because bad (negative) return would lead to a situation that investors are more likely to redeem their capital. The effect of line of credits on

capital flow is negative. If a fund used credit lines, its flow of next period would decrease by 6.79%.

We expected that after the usage of credit lines, the flow-performance sensitivity would be weakened. Although the negative sign of both interaction terms confirmed our hypothesis, the result is not significant at 95% level.

(2) and (3) used subsample after and before 2005, respectively. We observed very similar result for the subsample after 2005. However, we also found the effects of *perneg* and *cl* are both insignificant in the period of 1995-2005. This might be because the number of observations before 2005 is too few to show a clear trend.

Table 5 Flow-performance Sensitivity and the Relationship with Credit lines (Full Sample)

Dependent Variable: flow of next period			
	(1)	(2)	(3)
	1995-2016	2005-2016	1995-2005
perfpos	0.585***	0.418***	2.273***
	(0.0325)	(0.0340)	(0.111)
perfneg	0.715***	0.758***	-0.320
	(0.0349)	(0.0353)	(0.213)
cl	-0.0679***	-0.0704***	0.00917
	(0.0105)	(0.0106)	(0.0657)
cash	0.00210***	0.00161***	0.00841***
	(0.000110)	(0.000114)	(0.000427)
cl*perfneg	-0.122	-0.0503	-1.210
	(0.326)	(0.334)	(1.484)
cl*perfpos	-0.140	-0.0255	-2.020
	(0.272)	(0.282)	(1.177)
cons	0.101***	0.102***	0.0603***
	(0.000936)	(0.000957)	(0.00414)
df_m	7	7	7
Time FE	YES	YES	YES
N	430218	395241	34977

Also, we used the subsample of institutional funds to find the different effects of determinants of flow for various investment sources. We expected different investors would be aware of the effect of line of credits. However, the result shows that the institutional investors are more complex (e.g., Evans and Fahlenbrach, 2012) and thus have stronger reaction to the usage of credit lines. Table 6 reports the result for institutional funds and retail funds. For the institutional funds, after the usage of credit lines, the flow will decrease by 12.4%. For their retail counterparts, the number would be 3.92%. The outflows of institutional funds would be about 3 times of the number of retail funds.

The effects of institutional funds' performance are very asymmetric while that of retail funds are very close. The coefficient of *perfpos* and *perfneg* for institutional funds are 0.292 and 0.613, the effects of bad performance is almost 2 times of that of good performance. However, for the retail funds, the coefficient is 0.744 and 0.840 respectively. This showed that for retail investors, it is easier for them to invest in or withdraw from the funds and the inflows and outflows are not strongly affected by the fact whether the funds perform well or not.

Table 6 Flow-performance Sensitivity and the Relationship with Credit lines

(Institutional and Retail Funds Flow)

Dependent Variable: flow of next period

	(1) 1995-2016	(2) 2005-2016	(3) 1995-2005
Institutional			
perfpos	0.292***	0.205***	2.020***
	(0.0544)	(0.0557)	(0.251)
perfneg	0.613***	0.638***	-1.560*
	(0.0557)	(0.0558)	(0.611)
cl	-0.124***	-0.124***	-0.101
	(0.0145)	(0.0147)	(0.0846)
cash	0.000940***	0.000570**	0.00866***
	(0.000201)	(0.000205)	(0.000964)
_cons	0.153***	0.153***	0.104***
	(0.00157)	(0.00159)	(0.00939)
N	167647	158435	9212
Retail			
perfpos	0.744***	0.531***	2.289***
	(0.0395)	(0.0418)	(0.121)
perfneg	0.840***	0.906***	-0.205
	(0.0441)	(0.0448)	(0.220)
cl	-0.0392***	-0.0379***	-0.0720*
	(0.00664)	(0.00675)	(0.0320)
cash	0.00339***	0.00291***	0.00846***
	(0.000126)	(0.000131)	(0.000468)
_cons	0.0662***	0.0667***	0.0457***
	(0.00114)	(0.00117)	(0.00452)
N	262564	236803	25761
df_m	4	4	4
Time FE	YES	YES	YES

CHAPTER 4

CONCLUSION

The liquidity issue of mutual fund is gaining attentions. While holding liquidity brings about a series of benefits to mutual funds, some researchers argue that holding too much cash reduces the efficiency of investment. In order to enjoy the benefits and mitigate the costs, we explore the rationale of line of credits.

We find that fund characteristics such as monitoring system and sales restrictions as well as macroeconomic environment will both influence the funds' decision on participating in the line of credit. Funds with better monitoring system, stricter sales restriction are less likely to apply for credit lines. Moreover, funds facing financial crisis are more likely to use credit lines, although the result is not significant on 95% level.

For the implications of using line of credit, we measure two aspects of potential influence. First, we focus on the substitutional effect of credit lines on cash holding. Empirical evidence shows that participating in the line of credits would significantly reduce the cash holding for mutual fund in the next time period. Then we examine the flow-performance relationship. We confirmed that the negative-return funds' capital flows are more likely influenced by the change in funds' performance. Using credit lines would reduce the capital inflow of funds. However, there is no

strong evidences show that the decision on credit lines would weaken the flow-performance sensitivity in our sample.

This paper serves as one leg of the benefit-cost analysis on funds' use of credit lines. Given the availability of data and limited time, we could not uncover the cost side of the instrument, which is left for future research.

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APPENDIX

In Table 7, we used the logarithm of loan balance amount as dependent variable instead of the simple amount. However, the result we got is not perfectly matched what we expected before. We listed the results in the next page.

Table 7 Determinants of Loan Balance Amount

Dependent Variable: *logarithm of cl_amount* (amount of loan balance)

	Predicted Sign	(1) 1995-2016	(2) 1995-2016	(3) 2005-2016	(4) 2005-2016
Characteristics of Funds					
inst	+/-	0.823***	0.815***	0.732***	0.721***
		(0.140)	(0.143)	(0.146)	(0.149)
load_dum	-	0.514**	0.486**	0.488*	0.486*
		(0.183)	(0.183)	(0.197)	(0.197)
timing	+	-0.132		-0.135	
		(0.135)		(0.137)	
		2.933	3.658	1.942	1.882
Controls		(13.16)	(13.41)	(14.19)	(14.36)
expr	-	0.141	0.130	0.196*	0.173
		(0.0915)	(0.0926)	(0.0991)	(0.0994)
turnr	+	0.374***	0.374***	0.404***	0.401***
		(0.0278)	(0.0283)	(0.0300)	(0.0304)
size	+	-0.449*	-0.611**	-0.465*	-0.662**
		(0.193)	(0.215)	(0.208)	(0.234)
flow	-	11.07***	11.06***	10.94***	10.96***
		(0.273)	(0.277)	(0.291)	(0.294)
cons		0.823***	0.815***	0.732***	0.721***
		(0.140)	(0.143)	(0.146)	(0.149)
df_m		7	6	7	6
Time FE		No	Yes	No	Yes
N		1843	1843	1631	1631